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136. (Amended) The imaging device according to claim 121, wherein said gate stack comprises a transfer gate stack and a reset gate stack.

137. (Amended) The imaging device according to claim 122, wherein said gate stack comprises a transfer gate stack and a reset gate stack.

138. (Amended) The imaging device according to claim 123, wherein said gate stack comprises a transfer gate stack and a reset gate stack.

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139. (Amended) The imaging device according to claim 124, wherein said gate stack comprises a transfer gate stack and a reset gate stack.

REMARKS

Reconsideration and allowance of this application, as amended, are respectfully requested. Claims 120-124 and 135-139 have been amended, and claims 146-149 have been canceled. Claims 1-4, 7-15, 18-23, 25-29, 31-39, 41-63, 65, 66, and 115-145 are now pending in the application. The rejections are respectfully submitted to be obviated in view of the amendments and remarks presented herein.

In the present Amendment, claims 120-124 have been amended in response to the rejections under § 112, first and second paragraphs. Claims 135-139 have been amended for improved readability. Claims 146-149 have been canceled because they are duplicative of claims 141-144.

Entry of each of the above amendments is respectfully requested.

35 U.S.C. § 112, First Paragraph

Turning to the Office Action, claims 66 and 135-149 stand rejected under 35 U.S.C. § 112, first paragraph. The Office Action asserts that “[t]he ‘processor’ (claim 53) for particular use in a ‘camera’ is unclear from the specification (page 19),” and that “[c]laims 135-149 are contrary to Figure 10.”

In response, claims 120-124 (from which claims 135-139 depend) have been amended to obviate the rejection of claims 135-149. Instant claim 120, for example, recites in pertinent part “a gate stack over said substrate, wherein said gate stack is disposed over an insulating layer of silicon dioxide which is over said substrate.”

With regard to claim 66, Applicant respectfully submits that the meaning of the term “processor” (claim 53) for use in a “camera” (claim 66) would be evident to any person skilled in the art from the context of the disclosure at specification page 18, line 28, through page 19, line 21. Applicant discloses that “[t]he illustrated system is exemplary of a device having digital circuits which include CMOS imager devices,” and that “[o]ther types of processor systems which include the same or similar systems of FIG. 11 include cameras, scanners, machine vision systems . . .”

From this disclosure, it would be abundantly clear to any person skilled in the art that the “processor” required for use in the claimed camera is a means for executing instructions, or programs having instructions, often known as a central processing unit

(CPU), or often simply described as a “processor.” See, for example, U.S. Patent No. 6,240,502 to Panwar et al., entitled “Apparatus for Dynamically Reconfiguring a Processor.” In the very first sentence of the Background section of the ’502 patent, Panwar discloses that “[e]arly computer processors (also called microprocessors) included a central processing unit or instruction execution unit that executed only one instruction at a time.” Panwar discloses that in the context of his invention, “the processor executes programs having instructions stored in main memory.” See also U.S. Patent No. 6,240,418 to Shadmon, which describes a “processor device [which] is capable of running at least one user application program capable of communicating with a database management system that includes database file management system, for accessing data records stored in said memory device.”

Thus, as is evident from the above-listed patents alone, the word “processor” is commonly employed terminology, and would be readily understood by any person skilled in the art.

Reconsideration and withdrawal, therefore, of the rejection of claims 66 and 135-149 under § 112, first paragraph, are respectfully requested.

35 U.S.C. § 112, Second Paragraph

Claims 140-144 and 149 stand rejected under 35 U.S.C. § 112, second paragraph. The Office Action asserts that “these claims contradict claims 135-139,” and that “[c]laims 146-149 are identical to claims 141-144.”

In view of the aforementioned amendment of claims 120-124 (from which claims 135-139 depend), the ground of rejection associated with claims 140-144 is deemed to be obviated. Claims 146-149 have been canceled because they are duplicative of claims 141-144.

In view of the aforementioned amendments, Applicant submits that the recitations of instant claims 140-144 are of the requisite degree of definiteness.

Reconsideration and withdrawal, therefore, of the rejection of claims 140-144 and 149 under § 112, second paragraph, are respectfully requested.

35 U.S.C. § 103 – “Acknowledged Prior Art” and Nagasaki

Claims 1-3, 7, 12, 14, 15, 18, 19, 25, 26, 28, 29, 31-33, 38, 39, 41-44, 46, 51, 53-55, 57-59, 66, and 115-119 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over “the acknowledged prior art in this application (Figures 1, 2, pages 1-12) and Nagasaki et al., considered together.”

The rejection of claims 1-3, 7, 12, 14, 15, 18, 19, 25, 26, 28, 29, 31-33, 38, 39, 41-44, 46, 51, 53-55, 57-59, 66, and 115-119 under § 103(a) as being unpatentable over acknowledged prior art and Nagasaki is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

The claimed invention would have been unobvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine reference teachings.

With regard to Applicant's claim 1, the asserted combination fails to suggest Applicant's claimed imaging device comprising a "nitrogen containing insulating layer over said substrate and beneath said photogate."

It is respectfully submitted that the disclosure of Nagasaki cannot compensate for the deficiency of "the acknowledged prior art." Nagasaki discloses a solid-state imaging device containing an insulating film made of "a high dielectric material having a *high* relative dielectric constant" (column 11, lines 20-22)(emphasis added). The Office Action suggests that from Nagasaki (Figure 17; columns 2-3) it would have been obvious to use an insulator with a higher dielectric constant in order to increase the capacity of the photogate.

However, while Nagasaki teaches the use of a high dielectric material, it also specifically teaches that silicon oxide and silicone nitride are *low* dielectric constant materials, while antiferroelectrics and ferroelectrics are high dielectric materials (column 3, lines 20-28). Nagasaki then proceeds to unequivocally and repeatedly exclude the use of low dielectric materials, including silicone oxide and silicone nitride, in its invention (column 4, line 57; column 5, line 42; column 6, line 33; column 6, lines 57-59; etc.)

As established above, by teaching the use of a material having a *high* relative dielectric constant, Nagasaki clearly teaches away from using nitrogen containing insulating materials. Nagasaki thus teaches away from Applicant's claimed invention. From the teaching of Nagasaki, therefore, it is not plausible to suggest that one of ordinary skill in the art would have used Applicant's claimed nitrogen containing material in place of a silicon oxide.

The Office Action asserts that it would have been obvious to use an insulator with a higher dielectric constant to increase the capacity of the photogate. No reference is cited, however, which suggests the use of a nitrogen containing insulating layer in the location claimed. Nagasaki does not teach or suggest that a nitrogen containing insulating layer would be useful for any purpose in the location claimed, much less to achieve the improved signal acquisition, wider dynamic range, and improved signal to noise ratio discussed, for example, at page 13, lines 10-20, and page 18, lines 20-24, of the specification.

Furthermore, at page 4, the Office Action states that "silicon nitride has a higher dielectric constant than silicon oxide," and then asserts that "Nagasaki et al (Figure 17) would have suggested the use of an "insulating layer" with a higher dielectric constant than silicon oxide." Applicant respectfully submits that the asserted conclusion improperly characterizes the issue at hand. While of course Nagasaki suggests the use of a material with a higher dielectric constant than silicon oxide, there is, for the following reason, absolutely *no* suggestion of Applicant's claimed "*nitrogen* containing insulating layer."

Nagasaki *teaches* the use of “a high dielectric material having a *high* relative dielectric constant” (column 1, lines 65-66). In Table 1 (column 3), Nagasaki discloses that “SiO₂” is a “low dielectric material” with a relative dielectric constant of 4.5, and that “Si₃N₄” is a “low dielectric material” with a relative dielectric constant of 10. Every other entry in Table 1, none of which includes nitrogen, is described as a “high dielectric material.”

Therefore, simply because Si₃N₄ has a higher relative dielectric constant than SiO₂ does not mean that the nitrogen containing Si₃N₄ would be acceptable to Nagasaki. Nagasaki teaches the use of “a high dielectric material having a *high* relative dielectric constant,” and the only nitrogen containing material in Table 1, Si₃N₄, is described by Nagasaki as being “a *low* dielectric material.”

Thus, the asserted combination would not have rendered obvious the various embodiments of the invention defined by any of Applicant’s rejected independent claims. The rejected dependent claims are allowable along with the aforementioned independent claims, and on their own merits.

Claim 14 recites an “imaging device including a semiconductor integrated circuit substrate ... comprising ... a nitrogen containing insulating material formed over [a] substrate and beneath [a] photogate.” Applicant submits that claim 14 is allowable for the same reasons outlined above for allowance of claim 1.

Claims 15, 18, 19, 25, 26, and 116 are dependent upon claim 14, and contain all the limitations of claim 14. Claims 15, 18, 19, 25, 26, and 116 are believed to be in

immediate condition for allowance for those reasons outlined above for the allowance of claim 14, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

Claim 28 recites “an imaging system comprising ... wherein a nitrogen containing insulating layer is formed over [a] substrate and beneath [a] photogate.” Applicant submits that claim 28 is allowable for the same reasons outlined above for allowance of claim 1.

Claims 29, 31-33, 38, and 117 are dependent upon claim 28, and contain all the limitations of claim 28. Claims 29, 31-33, 38, and 117 are believed to be in immediate condition for allowance for those reasons outlined above for the allowance of claim 28, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

Claim 39 recites “an imaging system ... wherein a nitrogen containing insulating layer is formed over [a] substrate and beneath [a] photogate.” Applicant submits that claim 39 is allowable for the same reasons outlined above for allowance of claim 1.

Claims 41-44, 51, and 118 are dependent upon claim 39, and contain all the limitations of claim 39. Claims 41-44, 51, and 118 are believed to be in immediate condition for allowance for those reasons outlined above for the allowance of claim 39, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

Claim 53 recites a “system comprising ... a CMOS imaging device ... including ... a nitrogen containing insulating layer over [a] substrate and beneath [a] photogate.” Applicant submits that claim 53 is allowable for the same reasons outlined above for allowance of claim 1.

Claims 54-55, 57-59, and 119 are dependent upon claim 53, and contain all the limitations of claim 53. Claims 54-55, 57-59, and 119 are believed to be in immediate condition for allowance for those reasons outlined above for the allowance of claim 53, and also because the unique combinations recited in these dependent claims are neither taught nor suggested by the cited combination of references.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 1-3, 7, 12, 14, 15, 18, 19, 25, 26, 28, 29, 31-33, 38, 39, 41-44, 46, 51, 53-55, 57-59, 66, and 115-119 under § 103 are respectfully rejected.

35 U.S.C. § 103 – “Acknowledged Prior Art” and Nagasaki, with Koike

Claims 4, 27, 45, 56, 120-144 and 146-149 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over “the acknowledged prior art in this application (Figures 1, 2, pages 1-12) and Nagasaki et al., further considered together with Koike et al.”

The rejection of claims 4, 27, 45, 56, 120-144 and 146-149 under § 103(a) as being unpatentable over acknowledged prior art and Nagasaki, further considered together

with Koike, is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

For all of the reasons identified above with respect to the rejection over the acknowledged prior art and Nagasaki, the claimed invention would have been unobvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine reference teachings.

Furthermore, it is respectfully submitted that the disclosure of Koike cannot compensate for the above-described deficiency of Nagasaki. Independent claims underlying dependent claims 4, 27, 45, 56, and 120-129 recite a nitrogen containing insulating layer over a substrate and beneath a photogate. Koike does not teach a nitrogen containing insulating layer. For this reason alone, claims 4, 27, 45, 56, and 120-129 are allowable over the asserted combination.

Additionally, claims 4, 27, 45, 56 recite a “semi-transparent conductor ... selected from the group consisting of indium-tin-oxide, tin oxide, indium oxide and doped hydrogenated amorphous silicon.” Koike in column 3 discloses “a material permitting light to permeate ... made of SnO_2 [tin-dioxide] or InO_2 [indium-dioxide] or a semi-transparent electrode made of polycrystalline silicon.” Therefore, Koike does not disclose the use of indium-tin-oxide, tin-oxide, indium oxide or doped hydrogenated amorphous silicon.

Further, because Koike does not remedy Nagasaki’s deficiency associated with the use of silicon nitride or other nitrogen containing insulating material, it cannot be

construed as also teaching any of the structural configurations set forth in claims 120-129. Claims 120-129 recite a “gate stack over [a] substrate and beneath [a nitrogen containing] insulating layer.” Nagasaki does not teach an insulating layer over any structure that can be comparable to a gate stack.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 4, 27, 45, 56, 120-144 and 146-149 under § 103 are respectfully rejected.

35 U.S.C. § 103 – “Acknowledged Prior Art” and Nagasaki, with Suzuki

Claims 8, 10, 11, 20, 22, 23, 34, 36, 37, 47, 49, 50, 60, 62 and 63 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over the acknowledged prior art (Figures 1, 2, pages 1-12) and Nagasaki, further considered together with Suzuki.

The rejection of claims 8, 10, 11, 20, 22, 23, 34, 36, 37, 47, 49, 50, 60, 62 and 63 under § 103(a) as being unpatentable over acknowledged prior art and Nagasaki, further considered together with Suzuki, is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

For all of the reasons identified above with respect to the rejection over the acknowledged prior art and Nagasaki, the claimed invention would have been unobvious because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine reference teachings.

Furthermore, it is respectfully submitted that the disclosure of Suzuki cannot compensate for the above-described deficiency of Nagasaki. Independent claims underlying dependent claims 8, 10, 11, 20, 22, 23, 34, 36, 37, 47, 49, 50, 60, 62 and 63 recite a nitrogen containing insulating layer over a substrate and beneath a photogate. Suzuki does not teach the use of a nitrogen containing insulating layer at the location claimed as opposed to a silicon oxide layer. For this reason alone, claims 8, 10, 11, 20, 22, 23, 34, 36, 37, 47, 49, 50, 60, 62 and 63 are allowable over the asserted combination.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 8, 10, 11, 20, 22, 23, 34, 36, 37, 47, 49, 50, 60, 62 and 63 under § 103 are respectfully rejected.

35 U.S.C. § 103 – “Acknowledged Prior Art” and Nagasaki, with Okada

Claims 8, 9, 13, 20, 21, 34, 35, 47, 48, 52, 60, 61 and 65 stand rejected under 35 U.S.C. § 103 as allegedly being unpatentable over the acknowledged prior art (Figures 1, 2, pages 1-12) and Nagasaki, further considered together with Okada.

The rejection of claims 8, 9, 13, 20, 21, 34, 35, 47, 48, 52, 60, 61 and 65 under § 103(a) as being unpatentable over acknowledged prior art and Nagasaki, further considered together with Okada, is respectfully traversed. The combined disclosures would not have rendered obvious the embodiments of the invention defined by any of the rejected claims.

For all of the reasons identified above with respect to the rejection over the acknowledged prior art and Nagasaki, the claimed invention would have been unobvious

because there is no suggestion or motivation, either in the references or in the knowledge generally available to one of ordinary skill in the art, to combine reference teachings.

Furthermore, it is respectfully submitted that the disclosure of Okada cannot compensate for the above-described deficiency of Nagasaki. Even if Okada teaches ONO, Okada does not teach or suggest its use as claimed. Independent claims underlying dependent claims 8, 9, 13, 20, 21, 34, 35, 47, 48, 52, 60, 61 and 65 recite a nitrogen containing insulating layer over a substrate and beneath a photogate. Okada, however, does not teach Applicant's claimed nitrogen containing insulating layer disposed over a substrate and beneath a photogate. For this reason alone, claims 8, 9, 13, 20, 21, 34, 35, 47, 48, 52, 60, 61 and 65 are allowable over the asserted combination.

For at least the above reasons, reconsideration and withdrawal of the rejection of claims 8, 9, 13, 20, 21, 34, 35, 47, 48, 52, 60, 61 and 65 under § 103 are respectfully rejected.

The canceled and/or amended claims have been canceled and/or amended solely for the purpose of furthering the prosecution of the present application. Applicant reserves the right to claim the subject matter of the canceled claims, the claims pending prior to this Amendment, and/or the subject matter of other claims embodied in this application, or any continuation, division, CPA, RCE, subsequent reissue, reexamination or other application. Any amendments made to the application are not made for the purpose

of distinguishing the claims over prior art except as specifically discussed in the Remarks section of this paper. Applicant may file a continuing application with claims that do not contain the limitations discussed in this paper, and Applicant expressly reserves the right to do so.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

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Respectfully submitted,

By 

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Version with markings to show changes made

Please amend the claims as follows:

120. (Twice amended) The imaging device according to claim 1, further comprising a gate stack over said substrate [and beneath said insulating layer], wherein said gate stack is disposed over an insulating layer of silicon dioxide which is over said substrate.

121. (Twice amended) The imaging device according to claim 14, further comprising a gate stack over said substrate [and beneath said insulating layer], wherein said gate stack is disposed over an insulating layer of silicon dioxide which is over said substrate.

122. (Twice amended) The imaging device according to claim 28, further comprising a gate stack over said substrate [and beneath said insulating layer], wherein said gate stack is disposed over an insulating layer of silicon dioxide which is over said substrate.

123. (Twice amended) The imaging device according to claim 39, further comprising a gate stack over said substrate [and beneath said insulating layer], wherein said gate stack is disposed over an insulating layer of silicon dioxide which is over said substrate.

124. (Twice amended) The imaging device according to claim 53, further comprising a gate stack over said substrate [and beneath said insulating layer], wherein said gate stack is disposed over an insulating layer of silicon dioxide which is over said substrate.

135. (Amended) The imaging device according to claim 120, wherein said gate stack [is comprised of] comprises a transfer gate stack and a reset gate stack.

136. (Amended) The imaging device according to claim 121, wherein said gate stack [is comprised of] comprises a transfer gate stack and a reset gate stack.

137. (Amended) The imaging device according to claim 122, wherein said gate stack [is comprised of] comprises a transfer gate stack and a reset gate stack.

138. (Amended) The imaging device according to claim 123, wherein said gate stack [is comprised of] comprises a transfer gate stack and a reset gate stack.

139. (Amended) The imaging device according to claim 124, wherein said gate stack [is comprised of] comprises a transfer gate stack [and a reset gate stack].